Antenna image above is WS1 at WSC

LEGS Locations

LEGS #1 White Sands, USA
LEGS #2 Matjiesfontein, South Africa
LEGS #3 Pacific Region: TBD, Australia

Antenna Information

FUNCTION	PERFORMANCE
Antenna Diameter	18m min.
Polarizations	Tx: RHC or LHC Rx: RHC & LHC
Antenna Travel Range[3]	±300⁰ Azimuth 0 to 90⁰ Elevation
Tracking Rate[3]	0.5⁰ /s velocity
Autotrack Accuracy (all bands) [3]	< 0.02⁰ 3 sigma (TBR)
Multiple Spacecraft Per Antenna (MSPA)	Up to 4 simultaneous return services per aperture (Max 3 Ka)

Services Information

FUNCTION	PERFORMANCE
Services	TT&C, CCSDS Forward and Return data, Tracking (Radiometric and antenna auto-track angles)
Radiometric Tracking (X-Band only)	Pseudo-Noise (PN) Ranging (CCSDS 414.1-B-2), 1-Way and 2-Way Doppler
Timing Reference[3]	short term stability better than 10^{-13}

Lunar Exploration Ground Sites (LEGS)

The LEGS mission is to provide direct-to earth communication and navigation services for missions operating from 36,000 kilometers (km) in the GEO to cis Lunar and beyond out to 2 Million km. To fully support distant orbits there will be three LEGS Government owned sites will be equally spaced around the Earth. The sites utilize data rates, modulation, and coding schemes for forward and return data as listed in the International Communication System Interoperability Standard (ICSIS) maintained by Human Exploration and Operations Mission Directorate. Specialized/unique Mod-Cods are optional. User Local Equipment on site is optional. LEGS facilities are built and operated to protect data up to HIGH security categorization with High Value Asset (HVA) overlays.

Ground system performance characteristics are provided in the below tables:

Radio Frequency (RF) Band	Forward	Return
	Freq Range	Freq Range
X-Band	7145 - 7235 MHz	8400 - 8500 MHz
Ka-Band	22.55 - 23.15 GHz	25.50 - 27.0 GHz

RF Performance Criterion	Radio Frequency Performance (Forward)	
	X-Band	Ka-Band
EIRP (minimum) [3]	86 dBW	89 dBW
Forward Distortions [2]	1 dB max	1 dB max
Carrier Modulation[1]	Direct PCM/PM, PCM/PM/PSK OQPSK, BPSK, Filtered OQPSK, Filtered BPSK, GMSK	Filtered OQPSK, Filtered BPSK, OQPSK, BPSK, QPSK, GMSK
FEC[1,6]	LDPC (½, ⅔, ⅘, ⅞), uncoded	
Max Data Rate[1,4]	10 Msps	50 Msps

RF Performance Criterion	Radio Frequency Performance (Return)	
	X-Band	Ka-Band
G/T (minimum) [3]	39 dB/⁰K	47.5 dB/⁰K
Implementation loss [2]	2 dB max	2 dB max
Demodulation[1]	Direct PCM/PM, PCM/PM/PSK, BPSK, QPSK, OQPSK, Filtered BPSK, Filtered OQPSK, GMSK	BPSK, QPSK, OQPSK, Filtered BPSK, Filtered OQPSK, GMSK, 8PSK
FEC[1,6]	LDPC (½, ⅔, ⅘, ⅞), Convo (½), RS + Convo(½,⅚)[7], Turbo Code (⅙, ¼, ⅓, ½)[8] , uncoded	
Max Symbol Rate[1,4]	20 Msps	200 Msps

Notes:

[1] Additional modulations, coding schemes, and data rates may be defined. Availability of data rates is dependent upon required spectrum authorization.

[2] GSFC CLASS link calculations use a 3dB implementation loss of which, the receive system is allocated 2dB and the transmit system distortions are allocated 1dB

[3] Performance data is preliminary pending finalization of system requirements, and may vary across facilities and apertures

[4] Max Symbol Rates provided are based on uncoded OQPSK and includes encapsulation protocol overhead. For the uncoded case, this is equivalent to Rcs of CCSDS 401x0B31

[5] BiPhase available with Direct PCM/PM and PCM/PM/PSK

[6] NRZ-L Symbol formatting required with LDPC codes

[7] CCSDS and NASA variants of concatenated codes are supported.

[8] Turbo codes limited to X-band